



# Analyses of the Risk Factors for Atrial Fibrillation Among the Patients Who were Admitted to Emergency Service

## Acil Servise Başvuran Atrial Fibrilasyonlu Hastaların Risk Faktörlerinin İncelenmesi

Atrial Fibrillation / Atrial Fibrilasyon

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### Özet

**Amaç:** Atrial fibrilasyon (AF) acil hekimlerince en sık karşılaşılan ve müdahale gerektiren önemli bir disritmidir. Tedavinin temel prensipleri presipite eden faktörlerin belirlenip ortadan kaldırılması, hemodinamik stabilizasyonun sağlanması ve hız kontrolü. Bu çalışmada biz atrial fibrilasyonu ve normal sinus ritmindeki iki grubu temel risk faktörleri ve karakteristikler yönünden karşılaştırarak önemlilikleri açıklamayı hedefledik. Gereç ve Yöntem: Çalışma acil servise başvuran toplam 280 hasta (175'i AF grubunda, 105'i ise normal sinus ritminde) ile yapıldı. Endikasyonu olan hastalar için ekokardiyografi ve koroner anjiyografileri kardiyoloji uzmanlarınca yapıldı. Kardiyoloji uzmanlarınca yapılan EKO ve koroner anjiyografi sonucunda gruplar kalp boşlukları, kapak patolojileri, sistolik pulmoner arter basıncı, ejeksiyon fraksiyonu, zirve aortik velositeleri ve koroner anjiyografi sonuçları yönünden karşılaştırıldılar. Ayrıca vücut kitle indeksi, glomerular filtrasyon hızı gibi risk faktörleri de incelendi. Bulgular: Yaptığımız çalışmada AF ile koroner arter hastalığı ( $p=0.001$ ), yüksek vücut kitle indeksi ( $p=0.001$ ), düşük ejeksiyon fraksiyonu ( $p=0.001$ ), artmış pulmoner arter basıncı ( $p=0.001$ ), sol ve sağ ventrikül dilatasyonu ( $p=0.018$ ,  $p=0.003$  sırasıyla) ve sol atrium dilatasyonu ( $p=0.029$ ) arasında anlamlı bir ilişki bulunmuştur. Sonuç: Çalışma sonunda acil servise AF olup bir nedenle başvuran hastalarda özellikle artmış koroner arter hastalığı ve düşük ejeksiyon fraksiyonu bulunmuştur. Bu nedenle AF ile başvuran hastalar özellikle akut koroner sendromlar ve kalp yetmezliği yönünden daha dikkatli değerlendirilmelidir.

### Anahtar Kelimeler

Atrial Fibrilasyon; Acil Servis; Koroner Arter Hastalığı; Kalp Yetmezliği; Vücut Kitle İndeksi

### Abstract

**Aim:** Atrial fibrillation (AF) is the most common arrhythmia managed by emergency physicians. The principles of management are identification and treatment of precipitating or underlying causes, hemodynamic stabilization/rate control. In this study we compared the characteristics and risk factors among atrial fibrillation and normal sinus rhythm. Material and Method: We analyzed 280 patient (175 in atrial fibrillation group, 105 in normal sinus rhythm) who were admitted to emergency service. Echocardiography and coronary angiography was made by cardiology specialist in order to compare the cardiac chamber dimensions, valvular pathologies, systolic pulmonary artery pressure, ejection fraction, peak aortic velocity and coronary angiography results. Moreover risk factors like body mass index, glomerular filtration rate, admission blood pressures rate were also analyzed. Results: In this cross sectional study we have found a significant relationship between coronary artery disease ( $p=0.001$ ), high body mass index ( $p=0.001$ ), low mean ejection fraction ( $p=0.001$ ), high systolic pulmonary artery pressure ( $p=0.001$ ), increased left and right ventricular dilatation ( $p=0.018$ ,  $p=0.003$  respectively), left atrium dilatation ( $p=0.029$ ) and atrial fibrillation. Discussion: At the end of our study we found especially that there was a significant correlation with high body mass index, low ejection fraction, increased obstruction of coronary arteries. That's why patients with atrial fibrillation should be managed with more attention for acute coronary syndrome and heart failure.

### Keywords

Atrial Fibrillation; Emergency Service; Coronary Artery Disease; Heart Failure; Body Mass Index

## Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia, and affects nearly 1% of the population. It is a supraventricular chaotic tachyarrhythmia, characterized by uncoordinated atrial activation with consequent deterioration of atrial mechanical function. On the electrocardiogram (ECG), AF is characterized by the replacement of consistent P waves by rapid oscillations or fibrillatory waves that vary in amplitude, shape, timing, and associated with an irregular, frequently rapid ventricular response when atrioventricular (AV) conduction is intact. Its prevalence increases with increasing age; and is relatively infrequent in those under 40 years old, though, it is encountered in up to 5% of those over 80 years of age [1]. It accounts for approximately one third of hospital admissions for cardiac arrhythmias, and is the most common arrhythmia, managed by emergency physicians [2].

The principles of emergency management of AF are prevention of thromboembolism, haemodynamic stabilisation, and symptom relief [3].

Our aim, in this study, was to compare the characteristics of patients with and without AF, who were admitted to emergency department.

## Material and Method

### Patient group:

This was a cross-sectional study of consecutive 280 patients who were admitted to Emergency Department of Cumhuriyet University Faculty of Medicine between March 2009 and September 2009. Patients were classified into 2 groups; group 1 included 175 patients with AF and group 2 included 105 patients with normal sinus rhythm. Nihon Kohden 12 lead ECG device was used for ECG extraction. AF was defined as replacement of consistent P waves by rapid oscillations or fibrillatory waves that vary in amplitude, shape, and timing, associated with an irregular, ventricular response. Diagnosis of AF was confirmed by an expert physician, blinded to study plan, at Cardiology Department. Two groups were compared according to previous history, demographic, clinical and laboratory characteristics including echocardiography and coronary angiography in some of the patients.

Patients who have been smoking are accepted as active smokers. Admission systolic and diastolic blood pressure and heart rate were recorded. Blood pressure was measured by space-lab noninvasive monitors, and for heart rate, total number of QRS complexes within one minute was counted. Body mass index (BMI) was calculated by dividing the patients weight to her/his height<sup>2</sup>. Patients with a BMI between 18.8-24.9 kg/m<sup>2</sup> were considered as normal, the ones with a BMI between 25-29.9 kg/m<sup>2</sup> are included in overweight group and those over 30 kg/m<sup>2</sup> were accepted as obese.

### Collection of blood sample:

For blood glucose level, blood urea nitrogen and creatinine, venous blood sample was obtained and analysed with Synchron-LX20 device in biochemistry laboratory. Oxygen depletion/glucose oxidase enzymatic reaction was used for glucose laboratory analysis, blood urea nitrogen was determined with urea enzymatic reaction and creatinine with calorimetric alkaline PICRATE test. Venous blood, in tubes with Ca-EDTA, was analysed in hematology laboratory with Siemens-Advia device with photometric method for platelet counts. Thyroid function tests (freeT3, freeT4, TSH), were analyzed in nuclear medicine

laboratory with Architect-I200 device with chemolumens enzyme immunoassay method.

### Echocardiography:

Echocardiographic examinations were made with a cardiac ultrasound scanner (Vivid 4, GE) and a 2.5-MHz transducer in the left lateral decubitus position, with utilization of standard views and measurements by an expert echocardiographer according to the recommendations of the American Society of Echocardiography [4]. All echocardiograms were recorded by the same operator, who was not part of the study. Cardiac chamber dimensions were evaluated according to the most recent guidelines. Valvular pathologies, namely mitral, aortic and tricuspid stenosis or regurgitation were quantified according to recent guidelines [5]. Systolic pulmonary artery pressure (SPAP) was calculated as shown previously [4]. Systolic pulmonary artery pressure was classified as normal (<25 mmHg) and high (≥25 mmHg). Left atrium (LA) size was classified as normal and enlarged according to reference limits of the most recent guideline. Eighty four patients from AF group and 78 patients from NSR group underwent diagnostic coronary angiography.

Ethical approval was obtained from Cumhuriyet University Faculty of medicine with the record number 2009-06/4.

### Statistical Analysis:

Parametric data were expressed as mean±standard deviation, and categorical data as percentages. SPSS 15.0 (SPSS, Inc., Chicago, Illinois) was used to perform statistical analysis. Independent parameters were compared via Independent sample's t test. Categorical data were evaluated by chi-square test as appropriate. Correlations were evaluated by Pearson's correlation test. Multivariable logistic regression was used to evaluate independent parameters. A p value below 0.05 was accepted significant.

## Results

Among 280 patients who were admitted to ED, 175 were in AF group and 105 in NSR group. Mean age of patients in AF group was 67.7 ± 11.4 years and in Group NSR, it was 64.6 ± 10.1 years (p=0.67). There was no significant difference with regard to gender in AF and NSR groups (86, 49.1% male and 89, 50.9% female and 56, 53.3% male and 49, 46.7% female; respectively, p = 0.49).

Univariate differences between AF and NSR groups were shown in Table 1. Patients in Group AF had significantly higher BMI compared to those in Group NSR (p=0.005, Table 1).

In spite of the significant correlation between AF group and the risk factors, in the multivariate analysis we found that none of the factors determines the AF occurrence alone.

## Discussion

Atrial fibrillation, a supraventricular tachyarrhythmia, is uncoordinated atrial activation which is associated with mechanical dysfunction. General population prevalence of AF ranges between 0.4%- 1%, increases with age, and it peaks up to 8% among people over 80 years [6]. Valvular heart disease, coronary artery disease, hypertension, especially left ventricular hypertrophy, hypertrophic cardiomyopathy, dilated cardiomyopathy and congenital heart disease are thought to play a role in AF. Other important causes such as chronic obstructive pulmonary disease, open sinus node dysfunction, thyrotoxicosis, diabetes mellitus, hidden preexcitation syndromes, and autonomic ner-

Table 1. Characteristics of AF and NSR groups and their comparison results

	Group AF (n=175)	Group NSR (n=105)	P
Mean Age	67.7 ± 11.4	64.6 ± 10.1	p = 0.67
Gender(male/female)	86/89	56/49	p = 0.49
Active smokers	51	57	p=0.001
Diabetes mellitus	34	12	p=0.080
Hypertension	20	14	p=0.063
Patients under chronic beta blocker therapy	30	13	p=0.285
Patients under chronic angiotensin converting enzyme therapy	148	88	p=0.865
Patients under chronic acetylsalicylic acid therapy	157	96	p=0.631
Patients under chronic statin therapy	139	85	p=0.758
Mean BMI±SD	27.3±3,3	25.7±2,3	p=0.001
Mean Heart Rate±SD	115±20,3	79.7±10,6	p=0.001
Mean Systolic Blood Pressure(mmHg) ±SD	127.6±25,3	146.6±19,0	p=0.001
Mean Diastolic Blood Pressure(mmHg) ±SD	79.1±14,1	85.00±9,9	p=0.001
Mean admission Glucose Level±SD	134±50,7	136.8±37,1	p=0.62
Mean Blood Urea Nitrogen ±SD	26.2±15,5	23.9±11,6	p=0.116
Mean blood Creatinine level±SD	1.23±0.7	1.09±0.4	p=0.056
Mean blood free T3 level ±SD	2.27±0.7	2.14±0.5	p=0.095
Mean blood free T4 level±SD	1.34±0.8	1.31±0.3	p=0.74
Mean blood TSH level ±SD	1.28±0.9	1.33±0.8	p=0.62
Mean blood Platelet Count±SD	213000±80444	207000±52989	p=0.47
Glomerular Filtration Rate±SD	75.97±85,4	91.86±139,0	p=0.237
Mean Ejection Fraction (%)±SD	46.39±14,1	50.45±9,9	p=0.006
Pulmonary Artery Pressure (mmHg) ±SD	40.81±10,7	29.90±12,6	p=0.001
Peak aortic velocity (m/sec) ±SD	1.37±0.3	1.15±0.3	p=0.001
Patients with significant tricuspid valve pathology	134	55/102	p=0.001
Patients with significant mitral valve pathology	136	69/102	p=0.065
Patients with significant aortic valve pathology	135	67/102	p=0.038
Patients with significant pulmonary valve pathology	94	52/102	p=0.66
Patients with LV dilatation	147	69/96	p=0.018
Patients with RV dilatation	75	26/104	p=0.003
Patients with left atrial dilatation	125	50/95	p=0.029
Established Coronary artery disease with angiography	69/84	47/79	p=0.001
Left Anterior Descending coronary artery obstruction	55/84	38/79	p=0.025
Right Coronary Artery coronary artery obstruction	49/84	36/79	p=0.103
Circumflex coronary artery obstruction	47/84	27/84	p=0.014

vous system disorders may contribute [1]. BMI is pointed out in the most recent AF guideline as an important risk factor for the development of AF [1]. AF develops along with the transition of body mass index from normal to the overweight and obese categories; due to the enlargement in left atrium and new activations in atrial muscles [7]. Miyasaka et al. [8] analyzed trends in the incidence of AF and found that mean BMI was always over the normal range and it increased within the years periods among AF patients. The mean body mass index was higher in our AF group and also percentage of the patients in the AF group steadily increased with the transition of BMI from normal to overweight and obese categories. There are considerable evidences that atrial arrhythmias occur in relation with heart failure (HF). In patients with HF, changes like decreased atrial refractory period, increased heterogeneity of atrial repolarization and slowed atrial conduction can promote the development and maintenance of AF. Besides, neurohormonal alterations in renin-angiotensin-aldosterone axis increase the extracellular matrix fibrosis and hemodynamic changes might contribute AF in HF [9]. Controversially, there are also some evidences that AF begets HF. It is known that AF decreases the ejection fraction %20 by disturbing the atrio-ventricular synchrony [10]. Another mechanism of HF in AF is the tachycardia-induced cardiomyopathy. Ventricular function is reduced secondary to rapid ventricular responses. Reversible ventricular dysfunction due to the ventricular stunning occurs in rapid ventricular responses due to decrease in coronary blood flow without significant flow-limiting epicardial stenoses [11]. Dries et al [12] has also revealed from the literature that the prevalence of AF increases as the severity of HF increases, and is closely related to the severity of clinical symptoms. Mean ejec-

tion fraction (EF) of our patients with AF was significantly lower than the patients with normal sinus rhythm (p=0.006). We didn't found any literature about admission systolic, diastolic blood pressure and heart rates. In our study the admission mean systolic and diastolic blood pressures were significantly lower in AF groups compared with NSR groups (p=0.001, p=0.001). This could be due to the low ejection fraction among the AF group. Also antihypertensive drug use could be another reason. The correlation of left ventricular diameters and AF is shown by Framingham [13]. It was shown that dilatation and/or increase in left ventricular wall thickness could be predisposing to AF. Besides, decrease in the compliance of ventricular myocardium promotes atrial dilatation which also begets AF occurrence. Five percent depletion in ventricular wall increased the AF rate by 34% and a 4-mm hypertrophy in left ventricular wall increased AF by 28%. In the same study, it was also revealed that right ventricular dilatation increased the AF rate by twice. In our study we found that LV and right ventricular dilatation rates were statistically significant higher in the AF group compared to NSR group ( p=0.018, p=0.003 respectively). It is known that AF generally occurs due to the valvular obstructions which elevate atrial pressures and subsequently enlarge the atrial chambers. This dilatation is believed to lead to thinning and fibrosis of myocardium and conducting fibers, thereby, results in AF. Sanfilippo et. Al [14] observed symmetrical increase in right and left atrial sizes who had AF. In two studies it is shown that left atrium enlargement or larger left atrium volume is a risk factor for AF [15,16]. Atrial enlargement was more frequently observed in AF group than NSR group (p=0.029). AF occurrence rate is proportional to aortic valve gradient velocity, stenosis or insufficiency. ACC/AHA/ESC 2006 guideline[1] stated that AF was associated with aortic valve stenosis-insufficiency. In our study, peak aortic velocity was significantly higher than NSR group. Valvular heart diseases are associated with AF. In the Euro Heart Survey, 20% patients with persistent or permanent AF patients had valvular heart disease. Mitral valve disease, elevates left atrial (LA) pressures and enlarges their size, is generally the mostly related valve disorder that promotes AF [17]. The valvular heart disease rates in AF patients showed a variability between %20-%64 [18,19]. In our study, we found a signifi-

ant difference for aortic and tricuspid valve disease ( $p=0.038$ ,  $p=0.001$ ) between two groups. We didn't found a significant difference for mitral valve disorders.

Previously, the potential influence of coronary artery disease on AF was not clear. Whereas Sanoski [20] described coronary artery disease as a risk factor for AF. In the CASS [21] study, AF was found in only 0.6% of the 18,884 patients with documented coronary artery disease. Similar rate was observed in the Reykjavik [22] study. The rate was similar in a coronary artery study [23]. Frequency of stenotic coronary artery was significantly higher in AF groups than the NSR group ( $p=0.001$ ). Furthermore, we found that stenosis in left anterior descending and circumflex artery was observed more frequently in AF group compared to NSR group ( $p=0.025$ ,  $p=0.014$ ).

In conclusion risk factors like low ejection fraction, increased coronary artery disease, increased systolic pulmonary artery pressure must be kept in mind by the emergency physicians while they can impair the hemodynamic stabilization and AF can occur due to acute coronary syndromes.

Several limitations should be acknowledged in relation to the present study. For instance this is only a cross sectional study and is made with few patients. The results can show variabilities in a prospective study where more patients are included.

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